

SECTION _____

PRECAST/PRESTRESSED STRUCTURAL CONCRETE
COMPONENTS AND WALL PANELS

PART 1 – GENERAL**1.01 DESCRIPTION**

A. Work Included:

1. These specifications cover precast and precast/prestressed structural concrete construction, including precast beams, columns, double tees, flat slabs, steel lintel which support precast concrete and product design not shown on contract drawings, manufacture, transportation, erection, and other related items such as anchorage, bearing pads, storage, and protection of precast concrete.
2. Furnishing and installing caulking in vertical joints between wall panels.
3. Grout between wall panels and footing.
4. Grouting of roof joints only where there is a 1/4" or more mismatch in elevation of roof double tees.

B. Furnished But Not Installed:

1. Column anchor bolts, wall panel attachment plates cast in footing, and precast attachment plates cast in bond beams.

C. Related Work Specified Elsewhere:

1. Alternatives: SECTION _____
2. Shop Drawings: SECTION _____
3. Cast-in-place Concrete: SECTION _____
4. Concrete Unit Masonry: SECTION _____
5. Structural Steel: SECTION _____
6. Metal Fabrications: SECTION _____
7. Sheet Metal Work: SECTION _____
8. Holes by other trades: SECTION _____

9. Jobsite snow removal.
10. Dewatering of footing trench.
11. Door or window frames.
12. Caulking between precast and other material.
13. Access road for all weather conditions.
14. Removal of overhead obstructions, including power lines.

1.02 QUALITY ASSURANCE

A. Acceptable Manufacturers:

1. All precast structural concrete must be made by a PCI Certified Plant. **No other plant certification shall be accepted.**
 - a. Wells Concrete
 - b. Hanson Precast
 - c. other precasters need to have architect's and/or contractor's permission to bid
this project and provide documentation on the make-up of their standard wall panels i.e. wythe configuration, handling information, use/non-use of solid concrete zones, etc.

B. Erector Qualifications:

1. Regularly engaged for at least five (5) years in the erection of precast structural concrete similar to the requirements of this project and must be PCI Certified Erector.

C. Testing:

1. In general compliance with applicable provisions of Prestressed Concrete Institute MNL-116, "Manual for Quality Control for Plant and Production of Precast/Prestressed Concrete Products".

D. Requirements of Regulatory Agencies:

1. The following specifications, standards and codes are a part of these specifications:

- a. ACI 318 -Latest Edition - Building Code Requirements for Reinforced Concrete.
- b. AWS D1.1 - Latest Edition - Structural Welding Code.
- c. AWS D12.1 - Latest Edition - Reinforcing Steel Welding Code.
- d. PCI Manual 116 - Latest Edition. Dimensional tolerances for the double tee shown in this manual shall be used for the dimensional tolerances of wall panels.
- e. PCI Manual 116 - Latest Edition. Dimensional tolerances for precast beams.
- f. Dimensional tolerances for precast columns:
 - (1) Length: $\frac{1}{2}$ " or $\frac{1}{8}$ " per 10 feet of length, whichever is greater.
 - (2) Cross Sectional Dimensions: Less than 24 inches, $\pm \frac{3}{8}$ inch; 24 to 36 inches, $\pm \frac{1}{2}$ inches; over 36 inches, $\pm \frac{5}{8}$ inch.
 - (3) Position of Anchors and Inserts: ± 1 inch of centerline location shown on drawings.
 - (4) Horizontal Alignment (sweep): $\frac{1}{2}$ inch or $\frac{1}{3}$ inch per 10 feet length, whichever is greater.
 - (5) End Squareness: $\frac{1}{4}$ inch maximum.
 - (6) Blockouts: ± 1 inch of centerline location shown on drawings.
- g. Steel Construction Manual AISC - Eighth Edition.
- h. Prestressed Concrete Institute Design Handbook - Latest Edition.
- i. Precast components to carry a _____ hour fire rating.
 - (1) IBC edition _____.
 - (2) PCI Rational Design.
 - (3) UBC.
 - (4) Wall panel joints shall be treated with appropriate thickness of ceramic material in accordance with required fire rating.
- j. See structural drawings for loading requirements.
- k. Forms:
 - (1) Forms shall be a permanent type, such as smooth steel.

- (2) Form oil or parting compound shall not impair future coating, caulking, or adhesives on the concrete surfaces. Wax emulsion or wax cutbacks will not be approved.
- (3) Wood forms with fiberglass finish to be used with specific architectural finishes (consult precaster for assistance).

1.03 SUBMITTALS

A. Shop Drawings:

1. Erection drawings:

- a. Plans and/or elevations locating and defining all material furnished by manufacturer.
- b. Sections and details showing connections, cast-in items, and their relationship to the structure.
- c. Description of all loose, cast-in, and field hardware.
- d. Field installed anchor location on drawings.
- e. Erection sequences and handling requirements.
- f. All dead, live, and other applicable loads used in the design.
- g. Show all solid concrete zones.
- h. Show all handling devices. Use side/edge devices where possible to minimize unsightly patching on visible faces.

2. Production drawings if requested:

- a. Elevation view of each member.
- b. Sections and details to indicate quantities and position of reinforcing steel, anchors, inserts, etc.
- c. Lifting and erection inserts.
- d. Dimensions and finishes.
- e. Prestressed for strand and concrete strengths.
- f. Estimated cambers.
- g. Method of transportation.

B. Product Design Criteria:

1. Loadings for design:
 - a. Initial handling and erection stresses.
 - b. All dead and live loads as specified on the contract drawings.
 - c. All other loads specified for members where they are applicable.
 2. Design calculations of products not completed on the contract drawings shall be performed by a registered engineer experienced in precast and prestressed concrete design and submitted for approval upon request.
 3. Design shall be in accordance with applicable codes, ACI 318, or AASHTO Standard Specifications for Highway Bridges.
- C. Permissible Design Deviations:
1. Design deviations will be permitted only after the Architect/Engineer's written approval of the manufacture's proposed design supported by complete design calculations and drawings.
 2. Design deviations shall provide an installation equivalent to the basic intent without incurring additional cost to the owner.
 3. Interior face of sandwich type walls shall be adequately tied to exterior face to withstand and/or transfer design loads.
- D. Test Reports:
1. Reports of tests on concrete and other materials are to be submitted upon request.

1.04 INTERFACE WITH OTHER TRADES

Coordination of the requirements for other trades to be included in the precast should be the responsibility of the owner unless clearly defined otherwise in the contract documents.

The PCI manuals for quality control (MNL-116 and MNL-117) specify manufacturing tolerances for precast concrete members. Interfaces with other material and trades must take these tolerances into account. Unusual requirements or allowances for interfacing should be stated in the contract documents.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. All materials shall comply with the specifications, standards and codes quoted herein. The Architect/Engineer upon request shall be furnished satisfactory certification that all material incorporated in the precast concrete products comply with the requirements herein specified.
- B. Portland Cement:
 - 1. ASTM C150 - Type I or III.
- C. Other cementitious materials:
 - 1. Ground granulated blast furnace slag: ASTM C 989.
- D. Admixtures:
 - 1. Air entraining admixtures: ASTM C260.
 - 2. Water reducing, retarding, accelerating admixtures: ASTM C494.
- E. Aggregates:
 - 1. ASTM C33 except that coarse aggregates for precast concrete surfaces exposed to damp conditions shall contain zero iron oxides.
 - 2. Some limestone aggregates used in architectural face mixes have high water absorption exceeding PCI requirements. Consult precaster on aggregates.
 - 3. Light weight aggregate structural components: ASTM.
- F. Water:
 - 1. Potable or free from foreign materials in amounts harmful to concrete and embedded steel.
- G. Reinforcing Steel:
 - 1. Reinforcing steel or mesh shall conform to the appropriate specifications and shall be free of grease and dirt. Reinforcing bars shall not be welded without specific approval of Architect/Engineer.
 - 2. Bars:
 - a. Deformed billet steel: ASTM A615.
 - b. Deformed rail steel: ASTM A616.
 - c. Deformed axle steel: ASTM A617.

- d. Deformed low-alloy steel: ASTM A706.
- 3. Wire:
 - a. Cold drawn steel: ASTM A82.
- 4. Wire fabric:
 - a. Welded steel: ASTM A 185.
 - b. Welded deformed steel: ASTM A497.
- H. Strand
 - 1. Uncoated, 7-wire, Stress-Relieved Strand: ASTM A416-Grade 250K or 270K.
- I. Anchors and Inserts:
 - 1. Materials: (Specify a, b, or c)
 - a. Structural steel: ASTM A36.
 - b. Malleable iron.
 - c. Stainless steel: ASTM A666, type 304, grade _____.
 - 2. Finish: (Specify a, b, c, or d)
 - a. Shop primer: Manufacturer's standards.
 - b. Hot dipped galvanized: ASTM A153.
 - c. Zinc-rich coating: MIL-P-2135, self curing, one component, sacrificial.
 - d. Cadmium coating.
 - 3. Finish of cast in bent plate.
 - a. Black iron.
 - b. Stainless steel.
 - c. Galvanized.
- J. Grout:
 - 1. Grout will be Type I unless specifically called out on plans to be Type III.
 - 2. Cement Grout: Portland cement, sand and water sufficient for placement and hydration.
- K. Bearing Pads:

1. Unless noted otherwise on the plans, Elastomeric Bearing Pads conforming to Division 2, Section 25 of AASHTO Standard Specifications for Highway Bridges shall be used.
 2. The PCI Design Handbook, Second Edition, Part 5.1 through Part 5.5 shall be used for the design of bearing pads.
 3. Teraflouroethylene (TFE) reinforced with glass fibers and applied to stainless or structural steel plates.
- L. Caulking:
1. Tremco Dymeric.
 2. Sonneborn.
 3. Backer rod shall be Denver foam unless noted otherwise.
- M. Welded Studs:
1. In accordance with AWS D1.1.
- N. Sandwich Panel Insulation: (Specify desired insulation type)
1. Extruded/expanded polystyrene insulation; thickness _____, R-value _____, includes concrete and air films.
 2. Panels to be non-insulated.
- O. Vapor Barriers. (Consult precaster on application)
- P. Column Protection: (None is required unless specifically called for on plan.)
1. Cast in a bent plate $\frac{1}{4}$ " x 8" x 4'-0" at each column corner with anchors. This is required only where shown on plans.
- Q. Pipesleeves: (None are required unless specifically called for on plans.)
1. $\frac{3}{4}$ " Conduit or PVC pipe.
 2. Location to be 4'-0" to 6'-0" on center, verify layout with electrical engineer.
 - a. Start 2'-6" in from outside walls.
 - b. Install in each roof and mezzanine double tee leg at 5'-0" on center.
 - c. Spacing shall be uniform and consistent throughout.
 - d. Unused pipesleeves to be caulked by others.

3. Pipesleeves to be capped.

2.02 CONCRETE MIXES

- A. 28-day compressive strength: Minimum of 5000 psi.
- B. Use of calcium chloride, chloride ions or other salts is not permitted.

2.03 MANUFACTURE - WALL PANELS

- A. Manufacturing procedures shall be in general compliance with PCI W4L-116. Items which must be prestressed are roof double tees, beams, interior and exterior wythes of flat wall panels, exterior of double tee wall panels and interior of double tee wall panels where required for design.
- B. Strand
 1. Both wythes of sandwich flat wall panels shall be prestressed.
 2. Exterior wythe of double tee panels shall be prestressed.
- C. Manufacturing Tolerances:
 1. See Article 1.02-E for requirements.
 2. All reinforcing steel shall have the minimum cover required by code and shall be accurately located as indicated on the approved shop drawings. Metal chairs, with or without coatings, shall not be permitted in the furnished face. Reinforcement shall be installed as indicated on approved shop drawings.
- D. Panel Width to be 10'-0".
 1. Consult precaster if job complexity warrants panel width other than 10'-0".
- E. Openings:
 1. Primarily on thin sections, the manufacture shall provide for those openings 12 inches round or square or larger as shown on the structural drawings. Other openings shall be located and field drilled or cut by the trade requiring them after the precast/prestressed products have been erected. Openings shall be approved by Architect/Engineer before drilling or cutting.
 2. All windows and door openings to be plant cast with wood nailers cast in around perimeter of all window and man door openings.
 3. Solid concrete finished edge around perimeter of overhead door openings.

4. If opening in panels are to be left as "concrete" finish or left untrimmed, painting contractor shall "knife and spackle" returns at openings prior to painting. Note: Add to painting specifications.

F. Handling devices and locations:

1. Handling devices shall be located at edges/vertical returns of panels to minimize patching at visible faces of panels.
2. If handling devices are used on visible faces of panels; such devices shall not minimize insulation area. Solid concrete zones are **not** acceptable.

G. Finishes:

1. Flat panel exterior: (Gray concrete used U.N.O.)

- a. Screed side finishes.

- (1) Uniform rake

- (a) 5/16" diameter teeth

- (2) Random rake.

- (3) Broom finish.

- (a) Integral color added to above finishes

- 1) Match Sample _____ in architect's office.

- (b) Integral color added to white cement.

- 1) Match Sample _____ in architect's office.

- 2) Plant applied clear sealer shall be used when integral color used with white cement base.

- (4) Interior finishes.

- (a) Hard trowel - USDA quality (interior/exterior use). – "Achieved by a three-step process." Architect to insist on review of existing projects or 3' x 4' sample.

- (b) Standard float.

- (c) Semi-hard trowel

- (d) Painting by others is recommended on all gray concrete surfaces.

2. Form side finishes:

- a. Standard smooth gray - note: form imperfections evident.
 - (1) Painting recommended by others.
 - b. Exposed aggregate finishes: Pattern as shown on elevations and partial enlargement.
 - (1) Use of chemical retard and high pressure washing.
 - (2) Use of sandblasting.
 - (3) Combination of 1 and 2.
 - (4) Acid etch.
 - a. combination of 4 and 2.
 - (5) Reveals - Rubber reveals used on steel forms.
 - (a) ½" Thick requires 3" exterior wythe.
 - (6) Cast on steel forms.
 - (7) Cast on wood forms.
 - (8) Cast on fiberglass wood forms to reduce form imperfections.
 - (9) Use of form liners.
 - (10) Use of brick thins. Brick thins shall have TBX tolerances. (consult precaster for acceptable brick thin suppliers).
 - c. Samples:
 - (1) Start with 12" x 12" to determine color/texture.
 - (2) 3' x 4' Production sample for final approval.
 - (3) Strongly recommend plant visit for full viewing once production commence.
3. Double tee wall panel exterior finishes:
- a. Gray concrete. Painting by others is recommended.
 - b. White cement/silica sand used in exterior only.
 - c. Exposed aggregate by chemical retard/high pressure washing.
4. Double tee wall panel interior finishes:

- a. Standard float (Warehouse grade).
- b. Hard trowel (USDA quality). "Achieved by a three-step process." Architect to insist on review of existing projects or 3' x 4' sample.
 - (1) Interior finish on screed side of wall panels shall receive a 3-step trowel process. The last step will use a troweling machine to provide a finish equal to the quality of a finished floor. Precaster to submit samples for Architect's review.
- c. Semi-hard trowel.

2.04 MANUFACTURE - STRUCTURAL COMPONENTS

- A. Top surface of double tee roof members shall be screed to true surfaces free from high and low areas and then floated to relatively smooth surfaces free from projecting gravel, footprints, or other defects to provide a finish suitable for application of membrane and insulation.

- B. PCI Specification:

- 1. Commercial Finish: This is essentially an "as cast" finish. Concrete may be produced in forms that impart a texture to the concrete, (e.g. plywood lumber or steel forms with offset joints, dents, or holes). The surface may contain air holes (bug holes) and water marks, and there may be some minor chips and spalls. There may be patches and streaks of color variation within the surface, and the overall color tone may vary between pieces.

Large fins from joint bleeding should be removed, but mall fins may remain. Only "honeycombed" and/or badly spalled areas should be repaired or finished. All faces should have true, well-defined surfaces. The maximum allowable form joint offset should be limited to 3/16" (5 mm).

This finish should be specified only when the product will not be visible in the completed structure, or when the function of the structure does not require an enhanced surface.

- 2. Standard Grade: Small surface holes caused by air bubbles ("bug holes"), normal color variations, normal form joint marks and minor chips and spalls should be considered acceptable.

No air holes (bug holes) larger than 1/2" (13 mm) in any direction should be permitted. Air holes between 1/4 and 3/8" (6 and 10 mm) in width that occur in high concentration (more than one per 2' ² [1300 mm²]) should be filled. Large, unsightly surface blemishes or honeycombing should be repaired. The maximum allowable form joint offset should be limited to 1/8" (3 mm). This finish may be used where products are exposed to view but the function of the structure does

not require a special finish. The surface should be suitable for an applied textured coating but not necessarily suitable for painting.

This is the typical finish grade for all structural products.

3. Grade B Finish: All air holes over 1/4" (6 mm) in size should be filled. Air holes between 1/8 and 1/4" (3 and 6 mm) in width that occur in high concentration (more than one per 2" ² [1300 mm ²]) should be filled. Surface blemishes due to holes or dents in form should be repaired. Discoloration should be permitted at form joints.

This finish may be used on visually exposed structural members such as columns or walls.

4. Grade A Finish: All formed finishes of structural components shall be considered Grade A resulting from the process of power washing all formed surfaces to expose latent pinholes, then rubbing the surfaces with a cement paste to fill in all pinholes.

Discoloration should be allowed at form joints. All form joints should be ground smooth.

This surface is suitable for painting (especially with a textured or "sand" paint); however, some surface blemishes will be visible. If a surface with fewer imperfections than allowed for "Grade A" is needed, the requirements should be specified as a "special finish." All air pockets and holes over 1/4" in diameter shall be filled with a sand-cement paste. All form offsets or fins over 1/8 inch shall be ground smooth.

- C. Exposed Vertical Ends: Strands shall be recessed and the ends of the members will receive a sacked finish.
- D. Screed side of precast columns shall be hard trowel.
- E. Openings:
 1. Primarily on thin sections, the manufacturer shall provide for those openings 12 inches round or square or larger as shown on the structural drawings. Other openings shall be located and field drilled or cut by the trade requiring them after the precast/prestressed products have been erected. Openings shall be approved by Architect/Engineer before drilling or cutting.
 2. Field-placed inserts, such as hand drilled or power drilled, may be placed in prestressed concrete sections by trade involved where required provided the installation of these inserts does not interfere with the reinforcing or prestressing steel. Installation shall be approved by precast supplier.
- F. Patching:

1. Patching will be acceptable providing the structural adequacy of the product and the appearance are not impaired.

G. Fasteners:

1. The manufacturer shall cast in structural inserts, bolts, and plates as detailed by the contract drawings.

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling:

1. Precast concrete members shall be lifted and supported during manufacturing, stockpiling, transporting, and erection operations only at the lifting or supporting points, or both, as shown on the contract and shop drawings, and with approved lifting devices. All lifting devices shall have a minimum safety factor of 5: 1.
2. Transportation, site handling, and erection shall be performed with acceptable equipment and methods, and by qualified personnel.

B. Storage:

1. Store all units off ground.
2. Place stored units so that identification marks are discernible.
3. Separate stacked members by batten across full width of each bearing point.
4. Stack so that lifting devices are accessible and undamaged.
5. Do not use upper member of stacked tier as storage area for shorter members or heavy equipment.

3.02 ERECTION

Installation shall be done by a PCI Certified Erector.

A. Preparation-the General Contractor shall be responsible for:

1. Providing true, level bearing surfaces on all field placed bearing walls and other field placed supporting members.

2. Placement and accurate alignment of anchor bolts, plates, or dowels in column footings, grade beams, and other field placed supporting members.
3. All shoring required for composite beams and slabs. Shoring shall have a minimum load factor of 1.5 x (dead load plus construction loads).
4. General Contractor shall provide all weather access roads for precaster's trucks and cranes. Refer to precaster's proposal/quotation for more define access requirements.
5. For long span DTs - No shipping of long span members shall occur during road postings. Seller's crane and trucks are to erect from the interior of the building area requiring long span members. Buyer is to provide a 50' wide access into the building and the clear erection area inside shall also be 50' wide. Trucks and crane to operate under own power. Maximum grade on which erection will occur to be 4%. Haul road to be approximately level transverse and 14% maximum longitudinal grade.
6. Obstructions, including power lines, wires, and objects which are hazardous to Seller's personnel shall be removed by Buyer.
7. Repair of all concrete and bituminous surfaces to be by others.

B. Erection Shall Be Defined As Including:

1. Placing, aligning, and leveling the members in final positions in the structure on the designated supporting surfaces.
2. Connection of precast members to each other, or to supporting structural members, as shown on the shop drawings.
3. Removal of lifting hooks, if necessary.
4. Cleaning and sealing all precast to precast joints.

C. Installation:

Installation shall be done by a PCI Certified Erector.

1. Only competent workmen who are properly trained to handle and erect precast concrete units shall be employed. All precast concrete units shall be erected level, plumb, square, and true within the allowable tolerances. They must be positioned so that dimensional error does not accumulate. Horizontal and vertical joints shall be correctly aligned and uniform joint width shall be maintained as erection progresses.

D. Alignment:

1. Members shall be properly aligned and leveled as required by the approved shop drawings. Variations between adjacent members shall be reasonable leveled out by jacking, loading, or any other feasible method as recommended by the manufacturer and acceptable to the Architect/Engineer.
- E. Joints Between Tees:
1. If the space between flanges of adjacent roof tees exceeds $\frac{3}{4}$ ", it shall be covered with a minimum 3 inch wide continuous 20 gauge galvanized sheet metal cover adhered on each side with plastic flashing cement. Cement shall not run into joints.
- F. Precast-prestressed concrete members shall be erected a minimum of 28 days after manufacture and connected in accordance with approved shop drawings. (This does not apply to columns or wall panels.) Consult precaster for requirements on specific products.

3.03 FIELD REPAIR/CLEANING

- A. The erector shall be responsible for any chipping, spalling, cracking, or other damage to the units after delivery to the jobsite. After installation is completed, any further damage is the responsibility of the General Contractor.
- B. Cleaning:
1. Architectural finishes exposed to the exterior: The precast erector shall be responsible for the washing/cleaning of the architectural finish to remove road film, effloresces, and to even out the color variation from panel to panel. The precast units shall be cleaned only after all installation procedures, including joint treatment, are completed. The architectural finishes shall be cleaned and rinsed in accordance with the precast manufacturer's recommendation.
 2. Interior face of architectural panels: During the exterior architectural finishing process, "color streaking" will occur on the backside/interior of the panels. Washing/cleaning the interior face shall be considered to be part of the painting section as means of preparing the surface for painting. Painting shall be considered, by others, as a means of concealing the "color streaking".
 3. Care shall be taken that no part of the building or surrounding site work be damaged.
 4. Washing/cleaning of precast shall be scheduled as to minimize the number of trips to the site. Washing/cleaning shall be done "one time" only unless other trips are required to even color. If the panels become soiled after the precast erector has washed/cleaned panels, it shall be the responsibility of the general contractor/owner to wash/clean panels.

3.04 CAULKING

- A. General contractor/owner shall coordinate with the precast erector the caulking of the precast joints where required. The general contractor accepts responsibility if the precast joints above the roof deck and below grade are not caulked do to poor coordination. The precast erector shall accept responsibility if precast joints are not caulked but, coordinated in a timely fashion by the general contractor/owner.

3.05 FIELD WELDING

- A. Field welding is to be done by qualified welders using equipment and materials compatible to the base material.

3.06 WARRANTY

- A. A twelve-month guarantee as to workmanship, material, and satisfactory performance from date of acceptance of the installation in service.

3.07 INSPECTION AND ACCEPTANCE

- A. Final inspection and acceptance of erected precast/prestressed concrete shall be made by Architect/Engineer to verify conformance with plans and specifications.